Hydro-Power in Denmark. General

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The Test Station for Windmills

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Hydro-power in Denmark - general

Small hydro plants have traditionally been quite important as an energy source in Denmark in spite of the limited resources available. Water stemming rights have typically been given as privileges to private persons, who have taken care of the building and maintenance of the plant and have used the mechanical energy for varying small industry or farming (milling grain, sawing wood etc.). These privileges are typically given to and kept with the once specified application and have been passed over to new owners of the application through inheritance or sale.

Today only about 36 of the best private privileges are still in use for energy production. In other cases the existing dams are used for trout breeding. Quite often it is easy to get permission to renew the power production equipment and restart the use of the privilege. New privileges are, on the other hand, very difficult to obtain because of the environmental problems (flooding of land, disturbance of natural water flow and fishing). Therefore people with an interest in small hydro will quite often start out finding older unused privileges which are quite abundant.

The 5 largest single hydro installations in use were actually made as concessioned companies according to a law in the 1920´es. The main stumbling block for these were the environmental problems concerned with the land use. For the same reason it is very difficult to start new large projects today.

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Nearly all hydro plants are presently grid-connected under the same rules that regulate the installation of windmills for grid connection. The rules are simple and common for most Danish utilities/hydro plants. The utilities are obliged to accept power from the plant.

As all alternative energy sources, small, privately owned hydro plants are eligible to obtaining a public subsidy in the form of a refund of 30% of the investment. The utilities may demand extra investment in form of a stengthening of the grid that takes up the power produced, if sufficient capacity is not available at the time of commissioning.

The electricity produced is bought by the local utility for a price that is calculated as follows. A percentage of the net selling price for electricity from a utility to a domestic consumer is the basis. The percentage can be 70% (for individual wind mill or hydro power plant owner) or 85% (for collective ownership). To this basis price is added a refund of a part of the Danish general electricity tax of 0.28 Dr. (refund 0.23 Dkr. + 0.051 DKr. Vat on the electricity tax). This refund is normal for alternative energy production in Denmark.

Hydro-power in Denmark - technical facts.

Resources.

Denmark is small, flat country consisting of one peninsula of app. 22000 sqkm area and several small islands (total area of the country 43000 sqkm). The highest point is only 173 m. The average fall of rain is about 650 mm. Consequently both water head and flow for even the best sites for water power stations are small compared to what is found in other countries. This makes small hydro plants interesting, albeit on a limited scale.

The largest hydro plant has a water collection area of app. 1500 sqkm, a head of 9 m, an installed electric capacity of 3.9 MW on a typical annual production of 12 MWh. Four other plants average an annual production of 2 MWh. A further 36 smaller plants are known.

The water head of the typical small plant is typical between 2 and 4 m the flow between 100 l/s and 1000 l/s.

The Francis turbine is commonly used. A few Crow flow turbines and 6 newly build water wheels are, however, also used.

The protection of the small turbines from weeds, tree branches and other mechanical pollution is a general problem of some importance in Denmark.

Table. Sales price for electricity from renewable energy plants to utilities.

	ownership	
	individual	collective
Average selling price, utility to consumer (DKr) typical	0.364	0.364
basis price percent	70%	85%
Basis price (DKr)	0.255	0.311
Refund of tax (DKr)	0.230	0.230
Refund of Vat on tax (DKr)	0.051	0.051
Selling price (DKr. pr. kWh)	0.536	0.592
Consumes baying from the utility (DKr.) typical	0.7442	

Baying price consist of production price on the power plant + tax + vat

Danish Currency i Ecu = app. 8.4 DKr.

Jørgen Krogsgaard

Hydropower in Denmark

Denmarks electricity consumption	28000 GWh/year
Electricity produced by hydropower	30 GWh/year
Hydropower port of the consumption i	1/100
Concessioned plants	8,8 Mw
Privat plants (36 pcs)	1,6 Mw
Total hydro	10,4 Mw
Denmarks largest hydro power plant	3,9 Mw
Further more effect (450 pcs)	14,0 Mw
Theoretical max power	40 Mw
Theoretical max production	75000 Mw/year
Wind power installed	100 Mw
Wind power production	120 GWh/year
Windpower as percentage part of the consumption	0,5%

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